Importance and Limits of the Cost-Benefit Analysis for GMOs Regulation

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Introduction

New technologies and innovations suspected to affect environment or public health need to be regulated. Scientific risk assessment is considered as a key element for the regulation. Its role is reinforced when the regulation has the potential of constraining the international trade. The Sanitary and Phytosanitary Agreement of the WTO dealing with this kind of issues gives primacy to scientific risk assessment. Interesting situations arise with small risks that is to say situations where the probability of damage is tiny and/or expected damages are very small. If risk assessment is the only scientific element considered, the mere presence of risk –even small- should give reason for regulation. Does it rationalize the public decision for all that? If the social benefits associated with the blocked activity are consequent accepting the risk could be worthwhile.

Recent works from the economic literature have shown that in order to get a good 'risk governance' cost-benefit analysis should be considered together with risk assessment (Bureau et al. 1998, Turvey and Mojduszka 2005). The aim of cost-benefit analysis is indeed to help public decision making. It consists in a set of methods that enables to evaluate the relevance of a regulation, comparing it with other possible options (from other types of regulation to the absence of any regulation). For that purpose cost-benefit analysis aims at estimating a monetary valuation, on the one hand, for environmental (or public health) degradation and, on the other hand, for the expected benefits implied by environmental conservation and technologies' development.

A particular relevant case of regulation of an innovation for the agro food sector is the regulation of biotechnologies. Genetically modified organisms (GMOs) indeed can be considered as a particular innovation that poses in both areas of environment and public health specific and new problems as well as valuable perspectives. On the risk aspects, threat on biodiversity and safety for human consumption are the two main risks usually associated with GMOs. On the benefit aspects, the first generation of GMOs were engineered in order to improve farmers' productivity whereas the second generation present enhanced nutritional contents.

Biotechnologies however are the 'textbook case' of the complexity of evaluating cost and benefit of innovation because of the specific characteristic this case presents: The novelty of biotechnologies, the ethical concerns that genetic modification techniques raise, the threat of potentially irreversible effects on biodiversity, the absence of scientific unanimity on the risk assessment, the importance of the economic perspective biotechnologies offer, the consumers fear, etc. However, cost-benefit analysis can be defended in order to develop a risk governance for biotechnologies in which, together with scientific assessment, economic stakes would be considered. This point is of particular importance at the international level where divergent GMOs perceptions of different States coexist and where the 'World Trade Organization (WTO) governance' scheme favours a scientific-based approach leaving little space for the economic aspects.

The aim of this contribution is therefore to underlines the importance of cost-benefit analysis when considering GMOs regulation and to highlight the difficulties this analysis is confronted with in that specific field. It argues that these difficulties should not be considered as a reason to put apart economic assessment. For that purpose, the contribution presents in a first section the aim and scope of the cost-benefit analysis in the field of GMOs. In the second section the main economic analyses are presented and the meaning of their results explored.

1. Aim and scope of the cost-benefit analysis on GMOs

The aim of the cost-benefit analysis is to rationalize the public decision. In evaluating costs and benefits this demarche enables to tell if the benefits of a given public decision exceed the cost implied. This analysis should therefore be undertaken in situation where the private decisions cannot give a suitable orientation. These situations arise in presence of market failures because of external effects or public goods or 'public bads'. In these situations, we cannot expect from the private agents to take into account in their decisions the social aspects (both social benefits and social costs) of their choices. For example, if only private consequences were attached to GMOs' introduction a cost benefit analysis would be useless. When social benefits and social costs are at stake a public decision is needed and cost-benefit analysis can be a useful tool to orientate it.

In order to apply cost-benefit analysis to the regulation of GMOs the ways GMOs affect environment and human health have to be established first. In a second step, the evaluation whether social benefits cover social costs has to be conducted. The demarche suggested in the case of GMOs is therefore to operate a sort of listing of GMOs consequences for farmers and society and for each consequence to evaluate if the good/bad is private or public (Weaver 2005), in order to estimate if a cost-benefit analysis is needed or if private decisions suffice.

Two kinds of social consequences can be distinguished in the case of GMOs. The first ones are the 'direct social consequences', that is to say consequences that totally escape to the farmers' decision process. The second ones are private consequences for farmers that however present public aspects that have to be evaluated.

The main direct social consequence in the first class is public health. Food-safety concerns over the potential long-run unknown consequences of ingesting GM-food are frequently pointed out. More precisely these matters relate to allergens and the use of antibiotic-resistant maker genes. These points totally escape from the sphere of farmers once a GMO has been approved for marketing. These risks have therefore to be evaluated before the premarket approval. Should they be translated into economic costs and confronted with the potential social benefits is an opened debate. The first group of consequences contains also public goods such a potential decrease in water use or 'public bads' such as the reduction in genetic diversity in cropping system or adverse effects on organisms that are not pest, such as beneficial or neutral insects.

GMOs very often present private and public characteristics. The first generation of GM crops, Ht and Bt, were engineered in order to improve farmers productivity. Ht crops are herbicide resistant and allow for a better control of weeds. Bt crops are insect resistant and allow for less insecticide use and reduced crops damage. The potential to reduce the application of chemical pesticides and herbicides directly concerns farmers. We could therefore estimate that a cost-benefit analysis is useless since no public dimension is present. This assertion however would ignore important social benefits and costs. To illustrate this idea, the case of Ht crops is considered (see Ervin et al. 2000). Ht crops imply a change in tillage practices since compared to conventional crops, less tillage is necessary. 'Conservation tillage methods' are adopted consequently and offers reduction in fuel use/labour and machine time. Together with a better control of weeds, these form private benefits associated with GM crops that can be compared with the cost of the seed. No public decision is a priori needed here. Scientific studies however

point that Ht crops and wild relatives could interbreed, making the latter more resistant to herbicide ('super weeds'). Once again, while with less certainty, this effect on the long-term efficacy of pesticide used could be taken into account by farmers and wouldn't need any public decision as a consequence. However, to control these stronger hybrid plants, farmers might respond by increasing the amount or toxicity of herbicides they apply. This can create an externality that farmers don't consider when choosing to turn to GM crops. In the same vein is the development of herbicide in wild relatives. The cost of this phenomenon has to be evaluated to have a complete cost of GM crops adoption. Furthermore, ecological studies pointed out that 'conservation tillage methods' reduces incorporation of plant residue or animal waste to amend the soil. They would also create a negative environmental effect on the soil structure making possible groundwater to surface effluent. Together with these negative effects, a positive one is presented with a reduced wind and water erosion allowed by 'conservation tillage methods'. All these negative and positive effects are external effects and need a cost-benefit analysis if they were to be taken into account by authorities when deciding Ht GMOs approval.

2. The main economic analysis undertaken and their meaning

In front of the many concerns, both positive and negatives, raised by the use of biotechnologies in agriculture, the cost-benefit analyses are not numerous and broadly tackle the problem in the same way. Many studies actually propose evaluations of the consumers willingness to pay (WTP) for GM foods (Marks et al. 2003). The intuitive idea of these studies is that people reveal their preferences for GM foods by showing their WTP for them. If GM foods are considered as an environmental and/or sanitary gain, the consumers' WTP should be positive. Alternatively, if GM foods are considered as an environmental and/or sanitary loss, consumers are willing to pay to prevent the loss or are willing to accept (WTA) to face the loss. Marks et al. (2003) provide an overview of the different approaches use to evaluate WTP in the case of GMOs and explain their diverging predictions, as well as their technical advantages and limits. They distinguished 'opinion surveys' from 'choice experiment' and 'experimental auction market methods'. They focused on the latter as the most reliable one.

Interestingly, studies that use experimental economics approach generally reveal positive WTP for both US and European respondants. These results contradict the generally accepted idea, especially in the European case, that consumers would shun biotech products if they were introduced (and labelled) on the markets. But what is the exact meaning in term of cost benefit analysis of these WTP expressed in experimental laboratory setting? What do the evaluated WTPs mean in environmental or sanitary terms?

Hobbs and Kerr note that consumers are concerned in two ways by transgenic crops: direct (tangible) consumption effect and indirect (intangible) existence-value effects. From a theoretical point of view, the WTP can therefore cover many things (Pearce and Turner 1990): existence value, option value, actual use value … In the empirical studies the announced WTP will depend, as a consequence, on the knowledge that respondants have before the experiment, on the way they are previously informed by the experimenters and on the way questions are asked. Different protocols will bring different results and may make comparisons difficult.[1]

As an example, Noussair et al. (2004), using experimental economics, confirm that the experimented consumers do not refuse to buy GM food, but note that an opinion survey would "accord greater weight to public dimensions such as negative externalities that result from widespread use of the product, than a bid in auction market", and can result in divergent results on the WTP

1. Development of parallel methodologies in ecological sciences may make comparisons difficult too.

as a consequence. In other terms we could advance that if the tested consumers do not know the environmental stakes of their consumption of GM products, the situation of external effect is basically artificially remade with the experimental protocol. In the experimental protocol of Noussair et al. (2004) general information about GMOs is given to consumers. But this information concerns only the definition of a GMOs, the criteria used for classifying a product as containing GMOs, the list of GMOs authorised in France, the food products sold in France that contain GMOs and finally, the French law regarding GMOs. No information on the scientific debate over GMOs' safety is provided and the situation of potential external effect cannot be appreciated by the tested consumers as a consequence.

The WTP evaluated in this kind of studies (or the change in the WTP in response to new information about GMO content of products) better reflects the consumers' preferences over GMOs rather than the social benefit/cost of GMOs. This kind of approach should not be rejected for all that since it forms a useful and precise tool for evaluating WTP in a context where the monetary evaluation of the GMOs' environmental impact is needed. Kleter and Kuiper (2005) for instance, studying the environmental impact of change in pesticide use on transgenic crops, underlines the advantage that a monetary evaluation forms in front of the plurality of physical evaluation of impact indicators that cannot easily be compared.

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